

Exhibit 2



US006236104B1

(12) **United States Patent**
Falster

(10) **Patent No.:** **US 6,236,104 B1**
(45) **Date of Patent:** ***May 22, 2001**

(54) **SILICON ON INSULATOR STRUCTURE FROM LOW DEFECT DENSITY SINGLE CRYSTAL SILICON**

(75) **Inventor:** **Robert J. Falster, Milan (IT)**

(73) **Assignee:** **MEMC Electronic Materials, Inc., St. Peters, MO (US)**

(*) **Notice:** This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

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(22) **Filed:** **Aug. 31, 1999**

Related U.S. Application Data

(60) **Provisional application No.** 60/098,902, filed on Sep. 2, 1998.
(51) **Int. Cl.⁷** **H01L 29/06; H01L 27/01; H01L 27/12; H01L 31/0392**
(52) **U.S. Cl.** **257/618; 257/347; 257/913**
(58) **Field of Search** **257/347, 618, 257/913**

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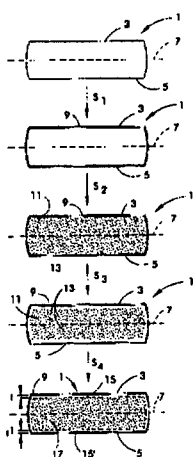
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(57) **ABSTRACT**

The present invention relates to a silicon on insulator ("SOI") structure having a low defect density device layer and, optionally, a handle wafer having improved gettering capabilities. The device layer comprises a central axis, a circumferential edge, a radius extending from the central axis to the circumferential edge, and a first axially symmetric region which is substantially free of agglomerated intrinsic point defects. Additionally, the present invention is directed to such a SOI structure which has a Czochralski single crystal silicon handle wafer which is capable of forming an ideal, non-uniform depth distribution of oxygen precipitates upon being subjected to the heat treatment cycles of essentially any arbitrary electronic device manufacturing process.

40 Claims, 35 Drawing Sheets



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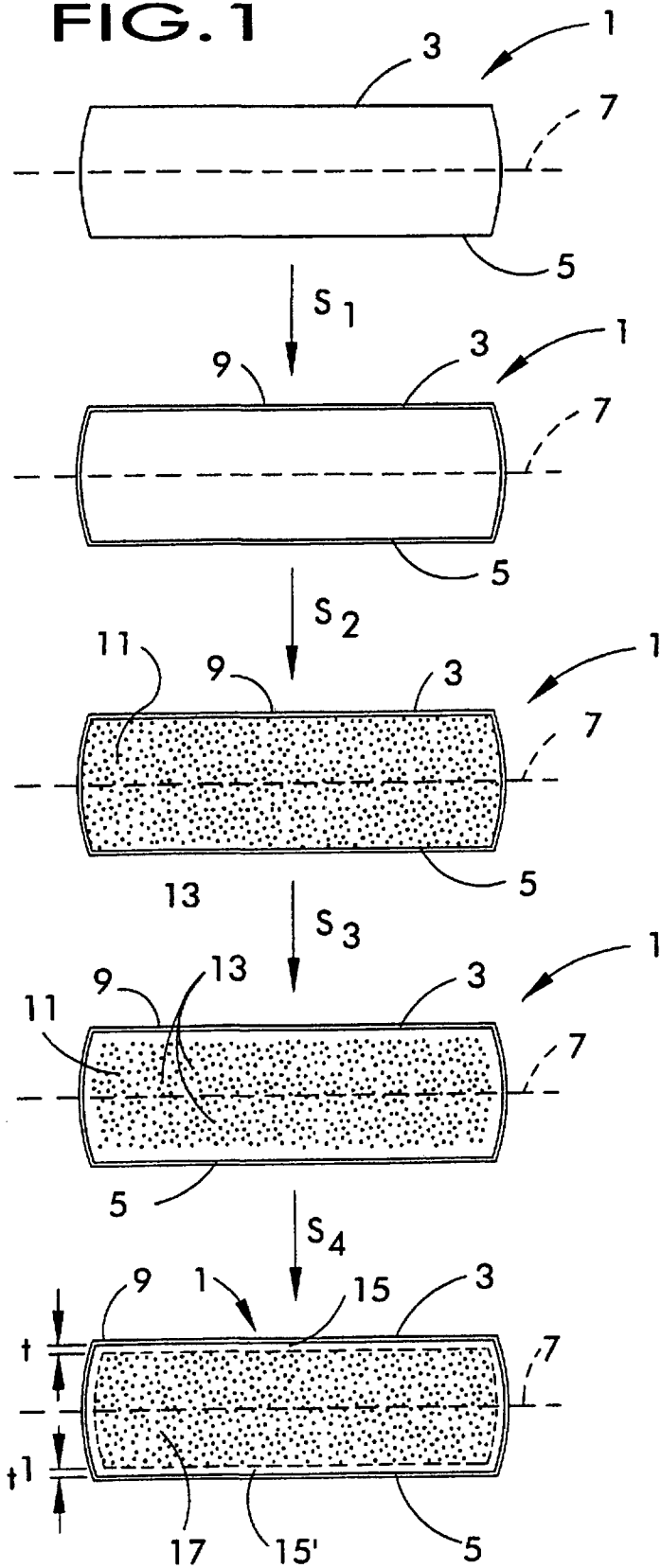
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FIG. 1



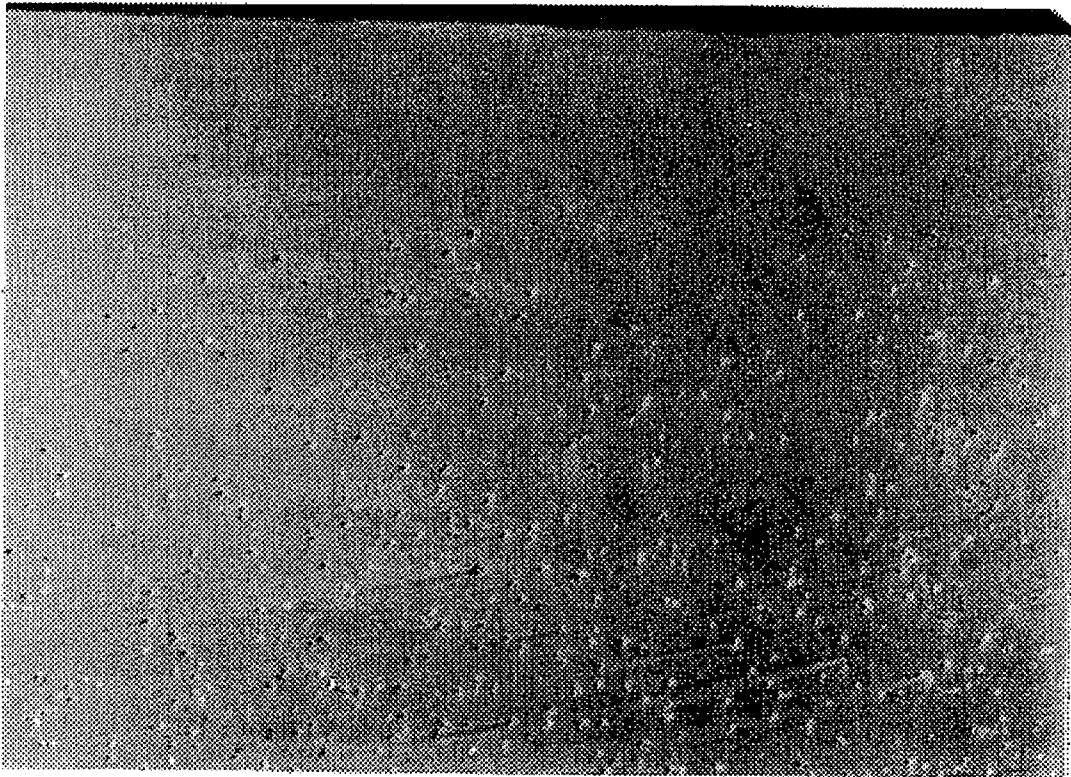
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FIG 2



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FIG. 3



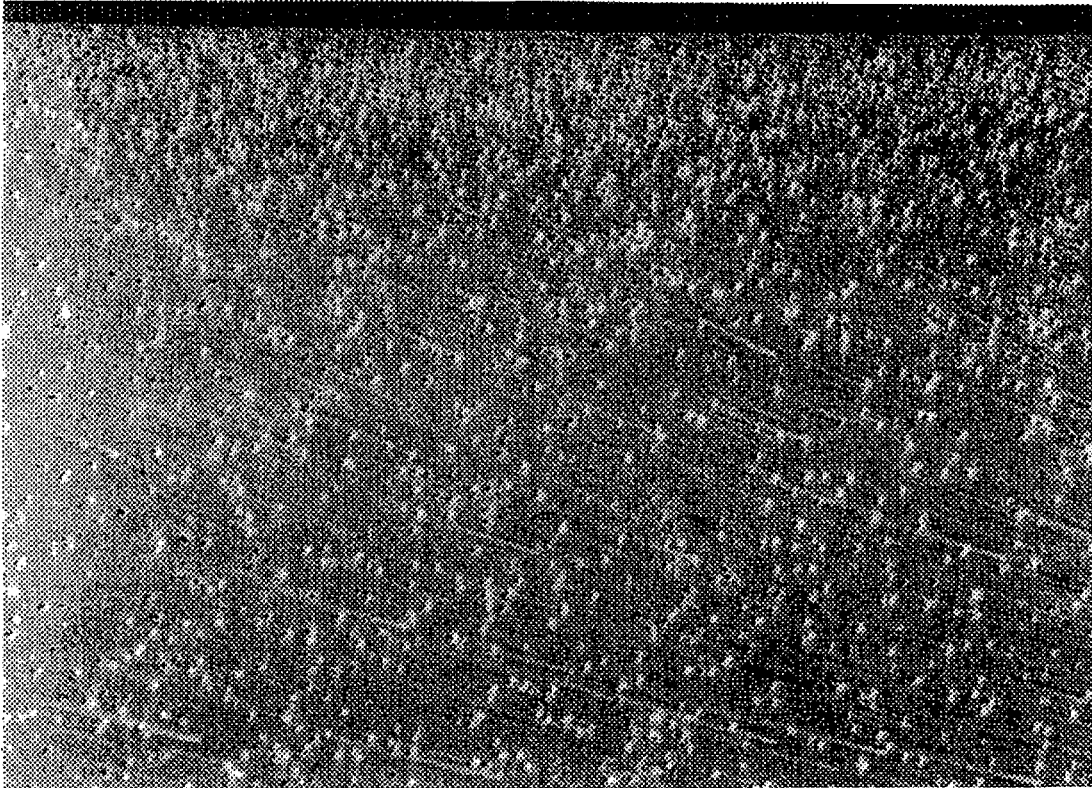
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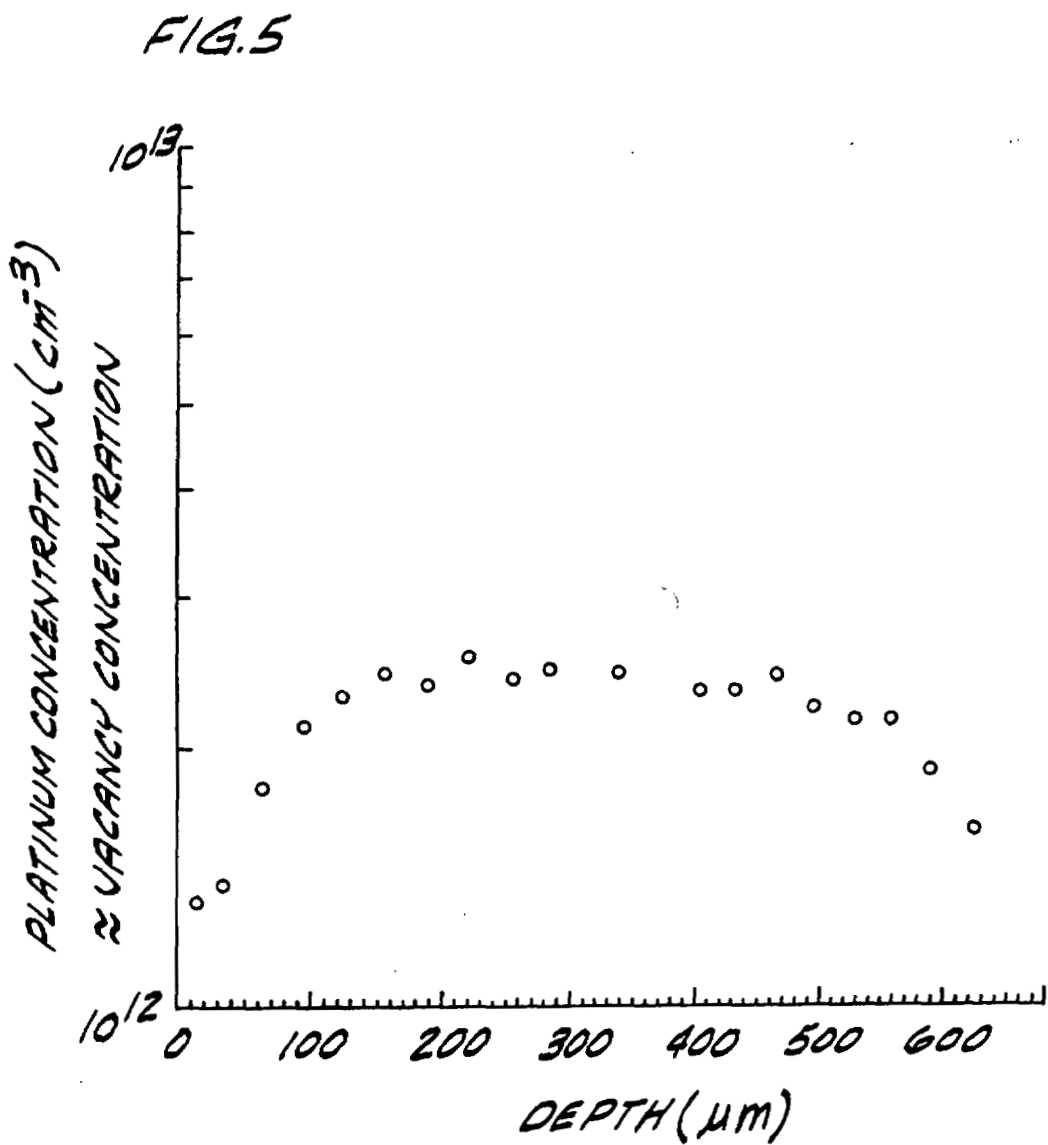
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FIG. 4





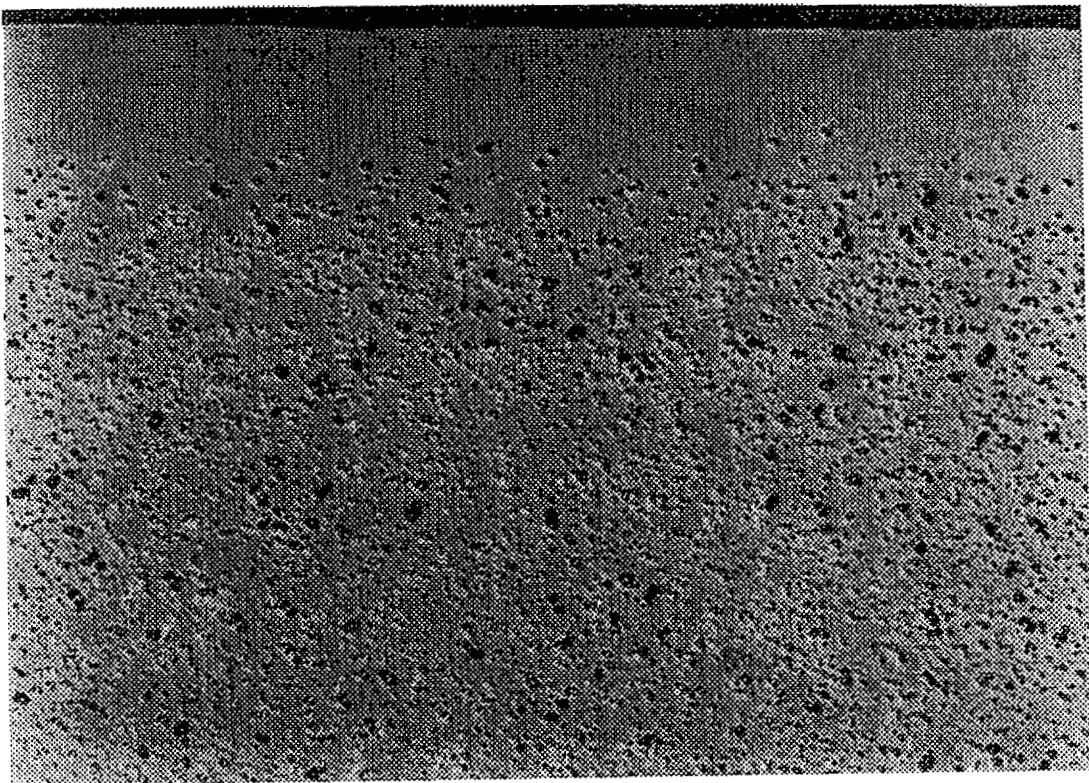
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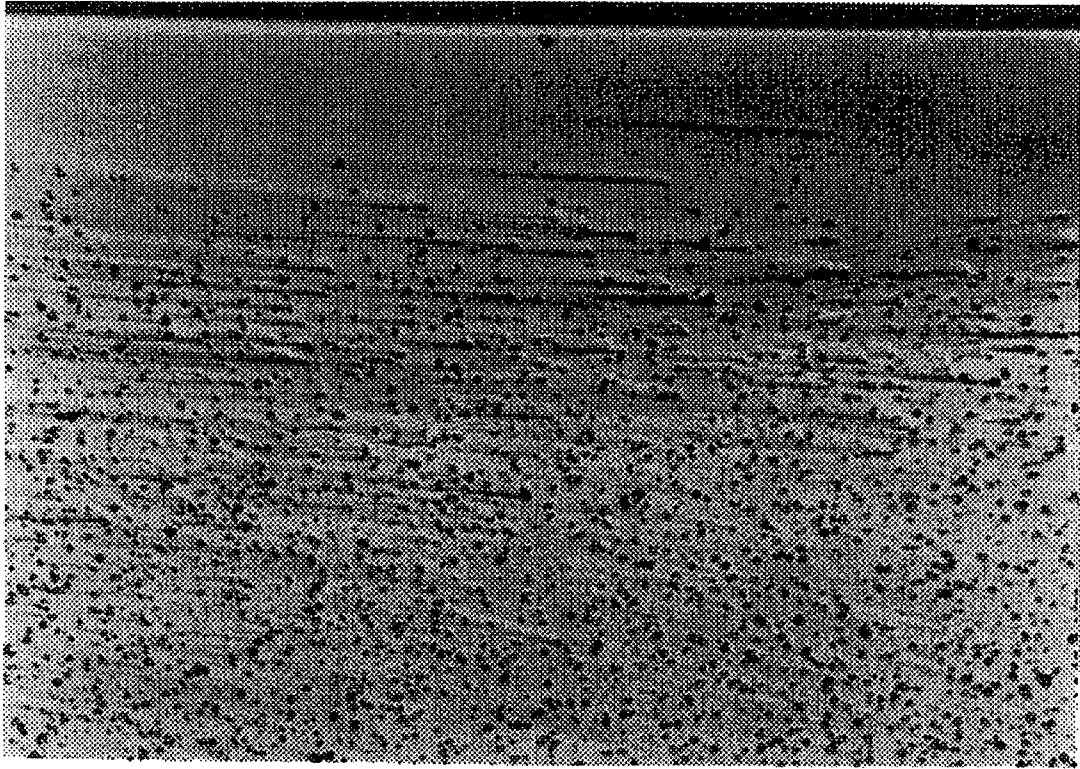
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FIG. 6



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FIG. 7



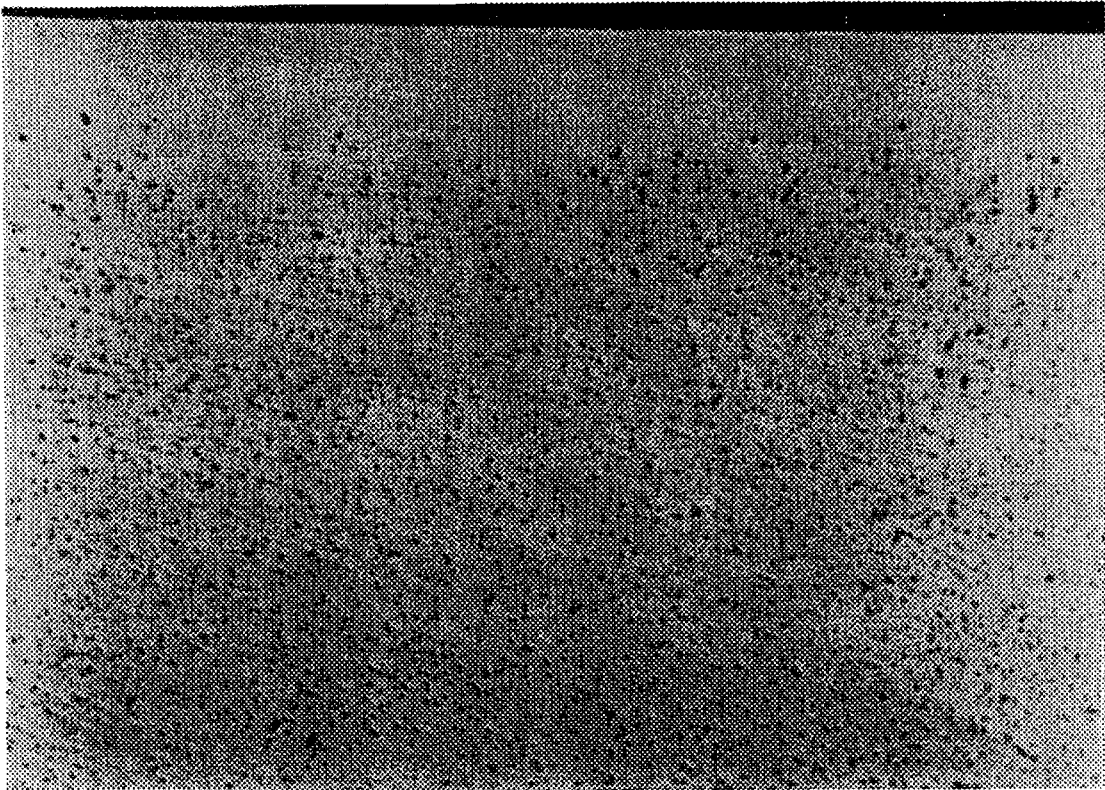
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FIG. 8



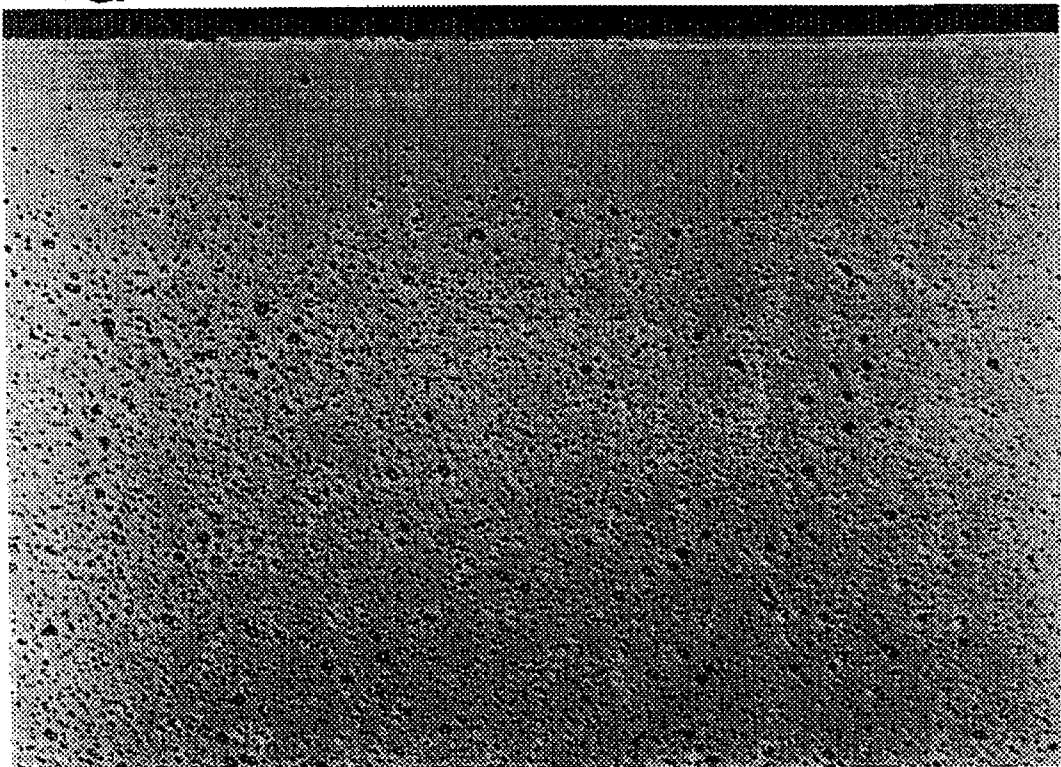
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FIG. 9



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FIG. 10

BMD DENSITY VS. OXYGEN PARTIAL PRESSURE

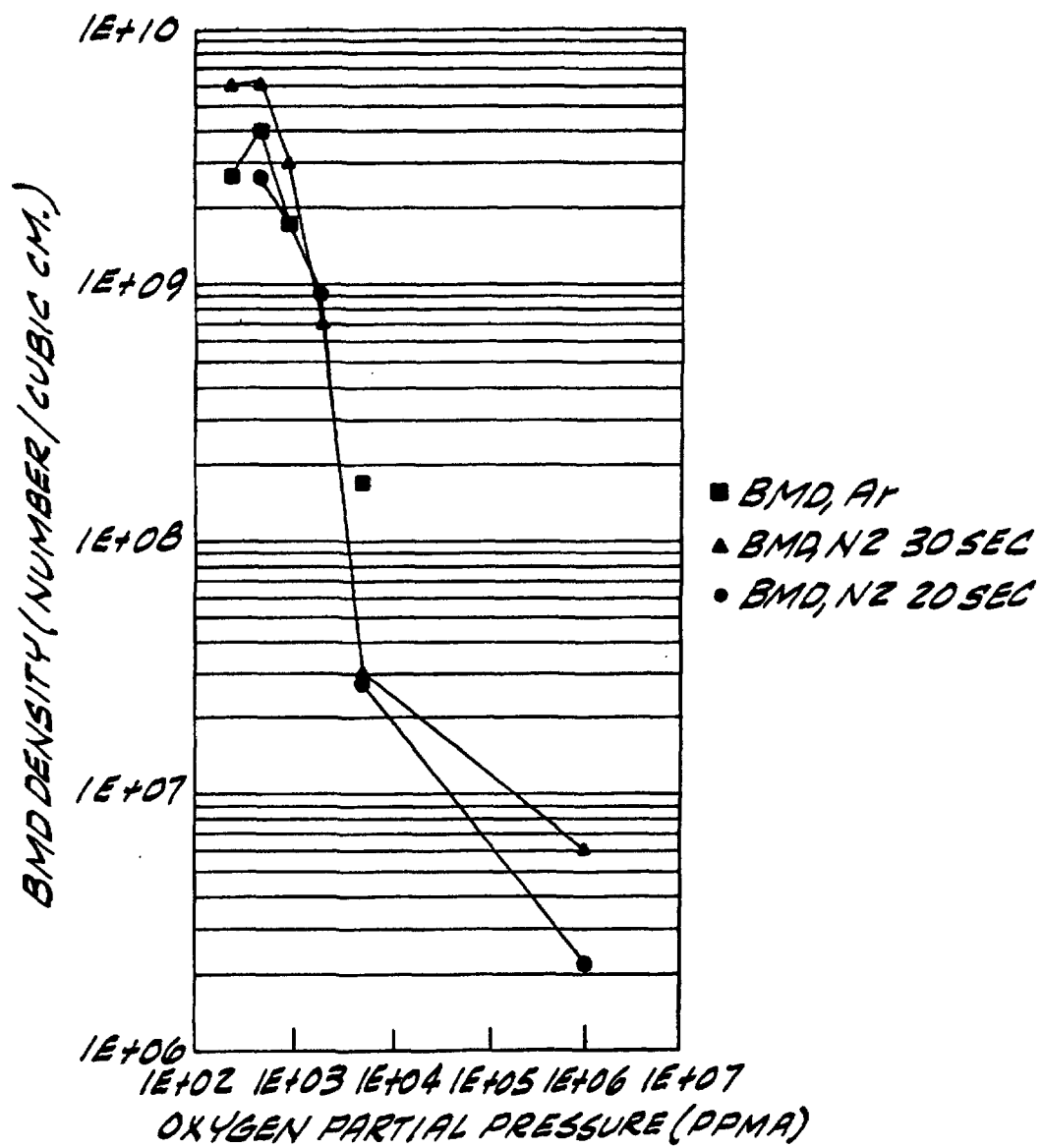


FIG.11

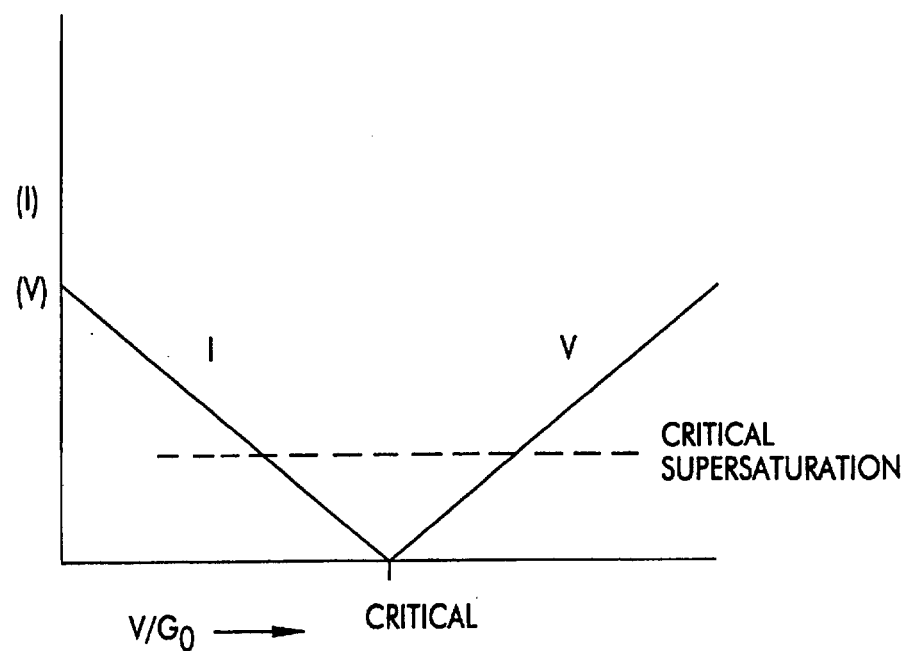


FIG.12

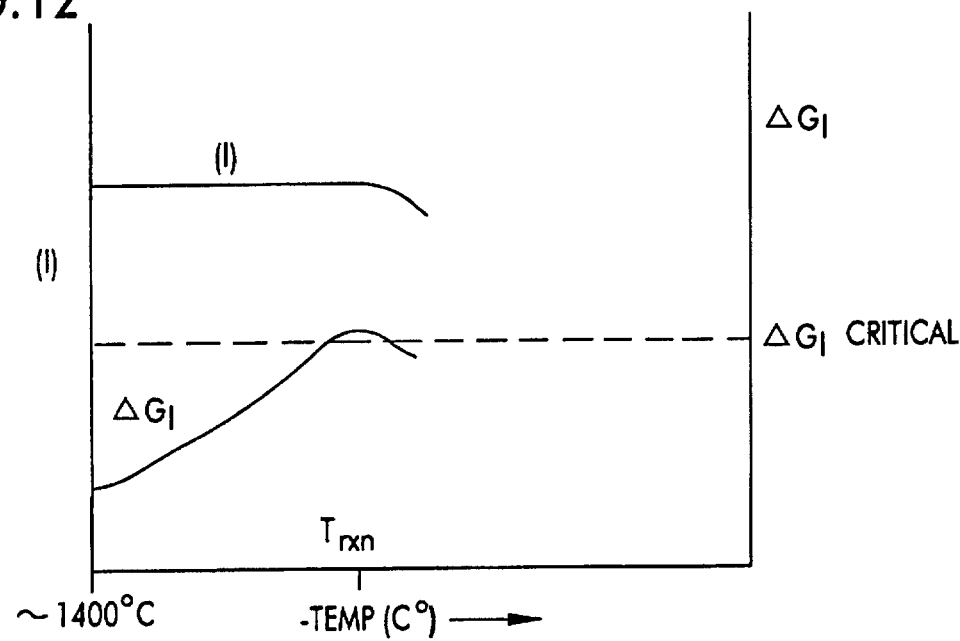


FIG.13

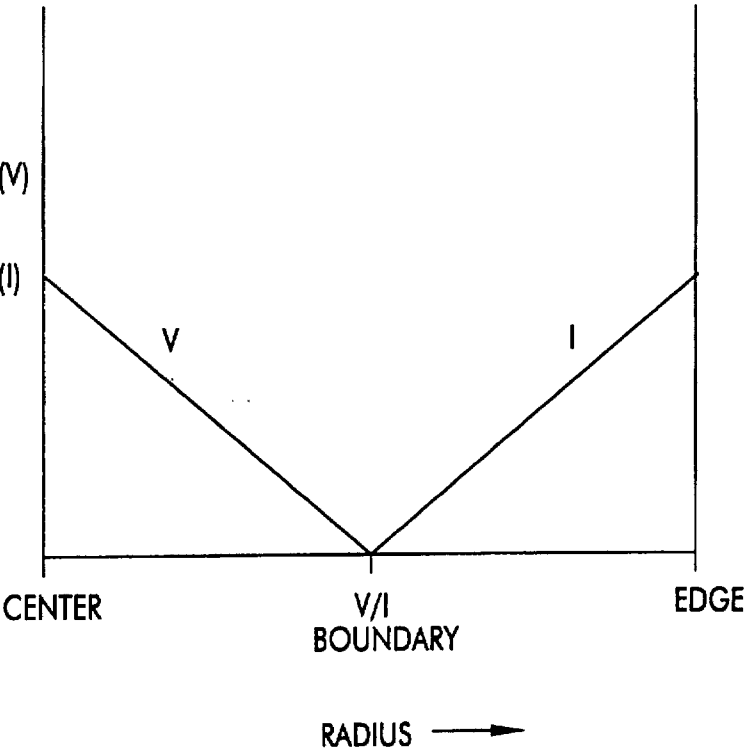
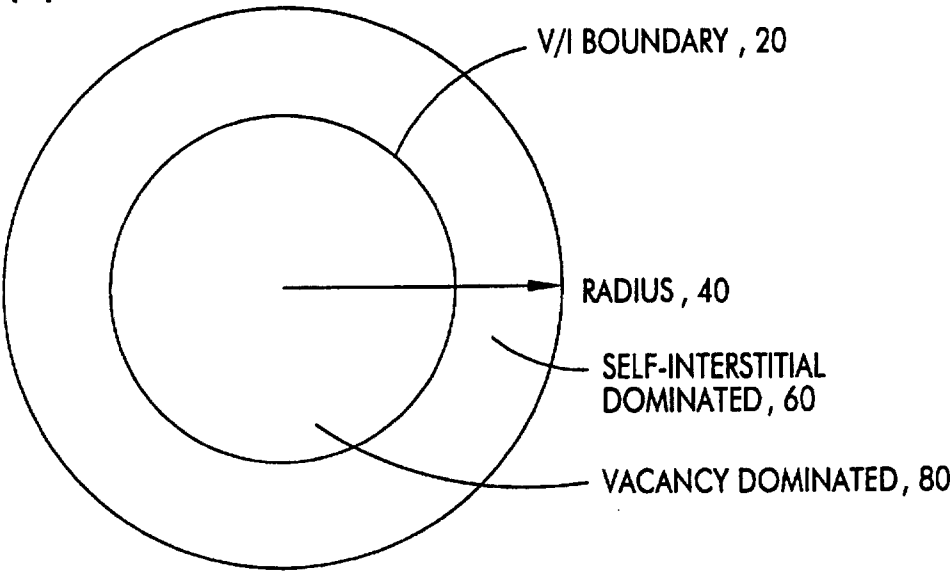
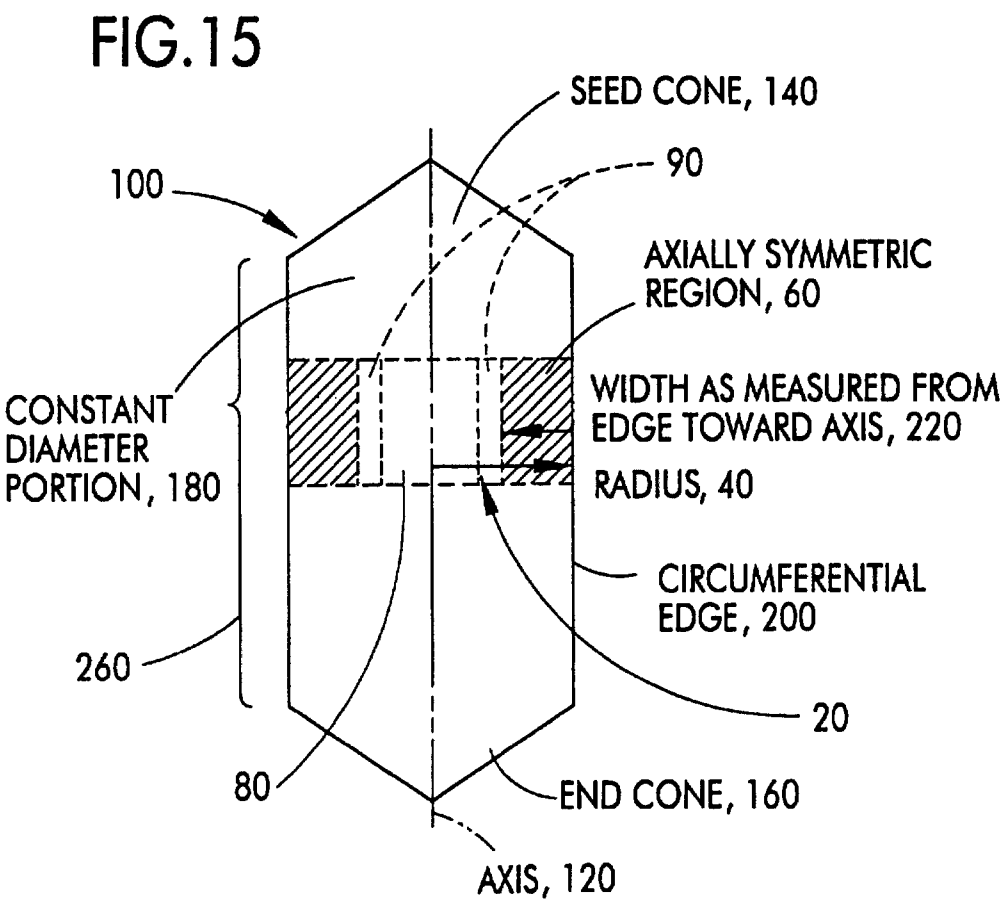


FIG.14





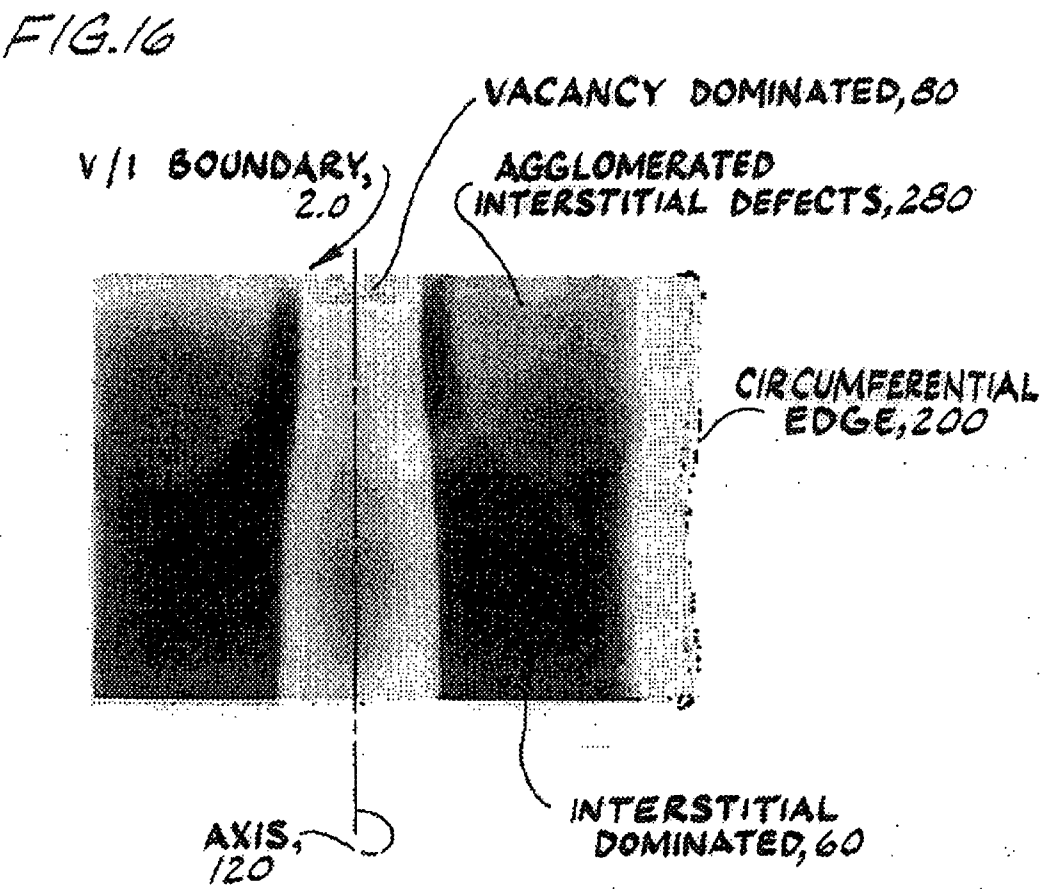
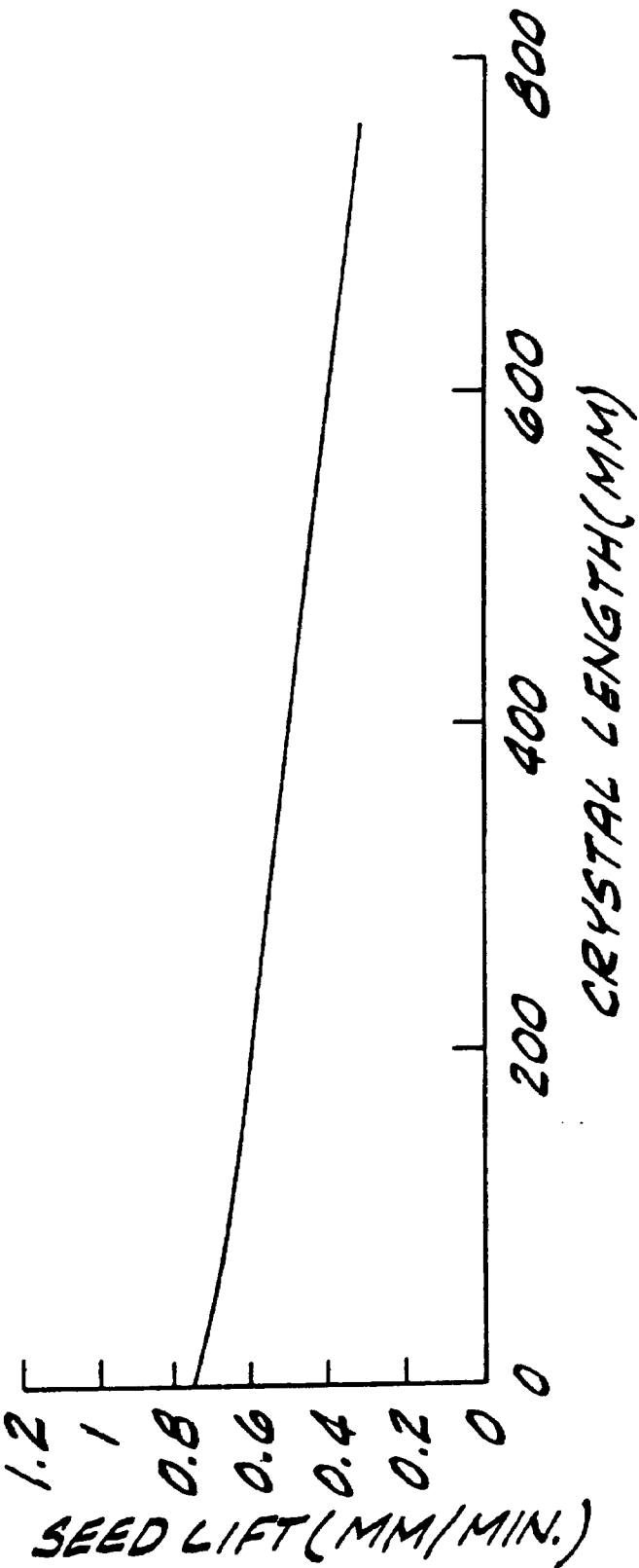


FIG. 17



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FIG. 18

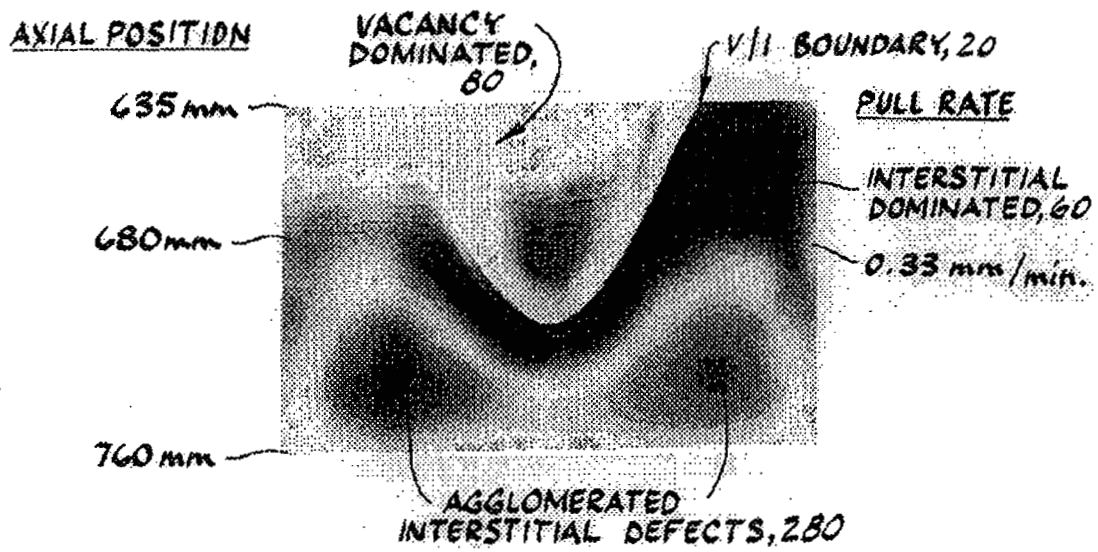


FIG. 19

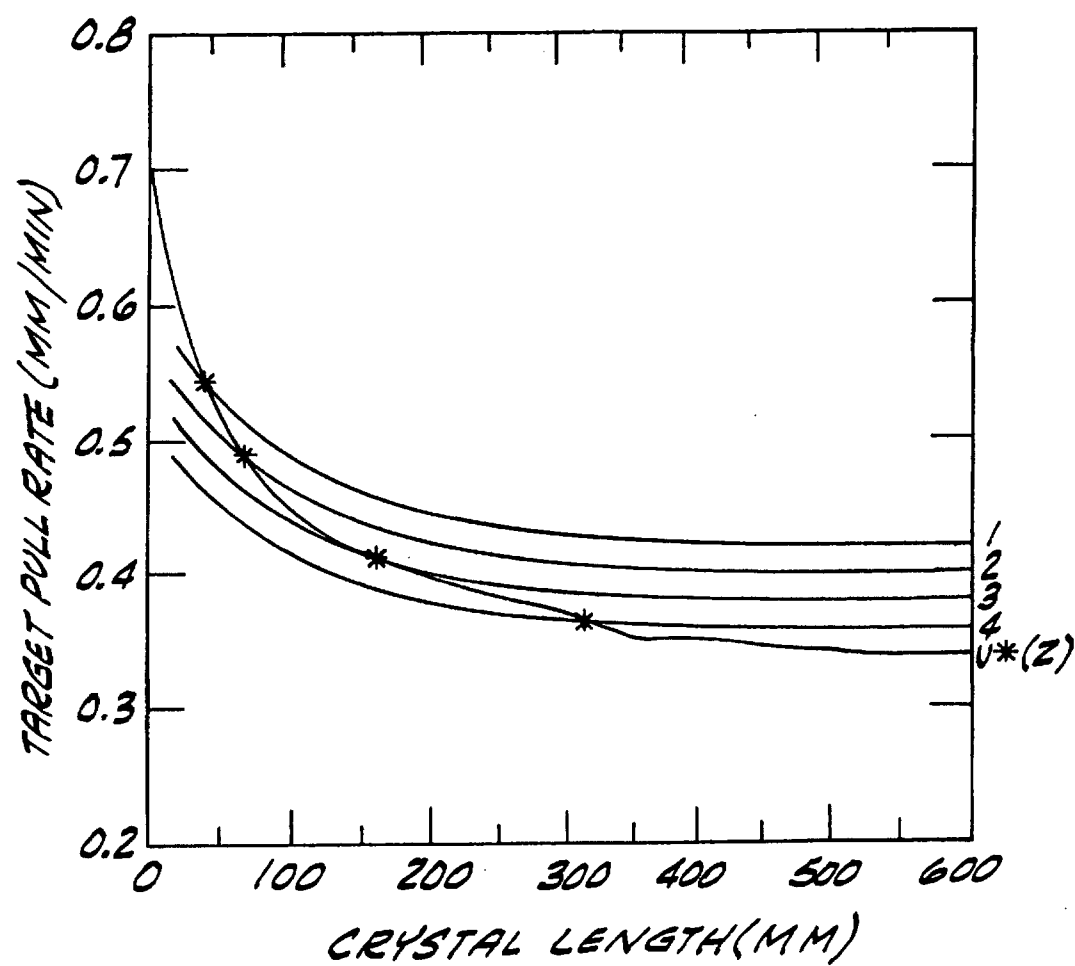


FIG. 20

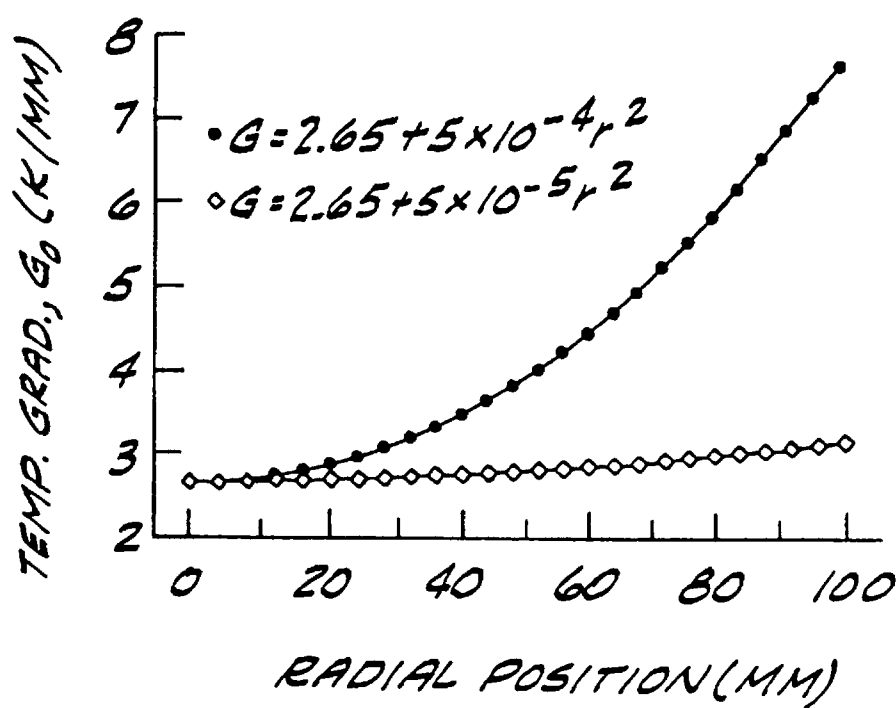


FIG. 21

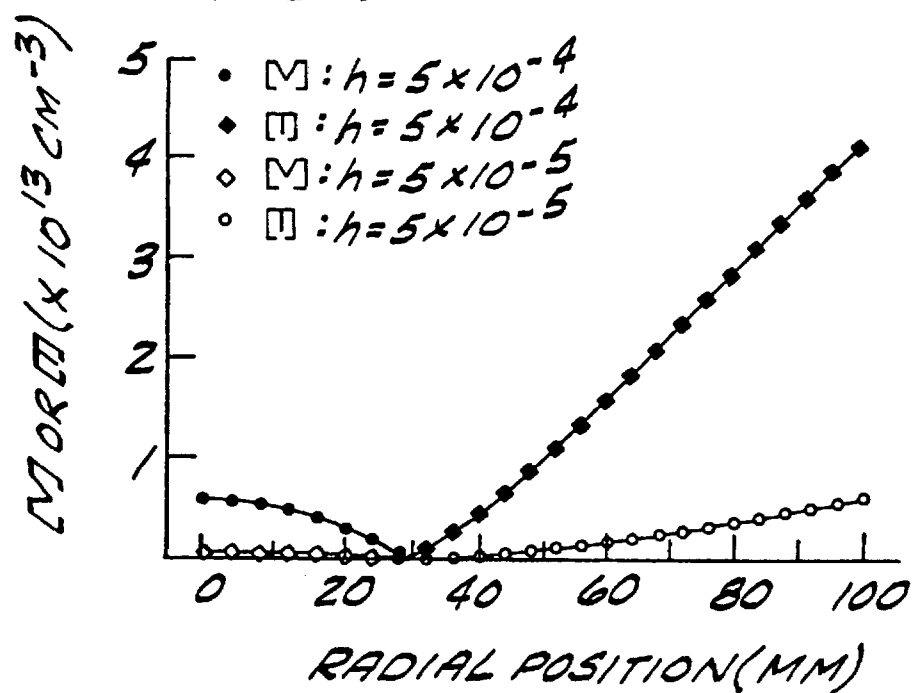


FIG. 22

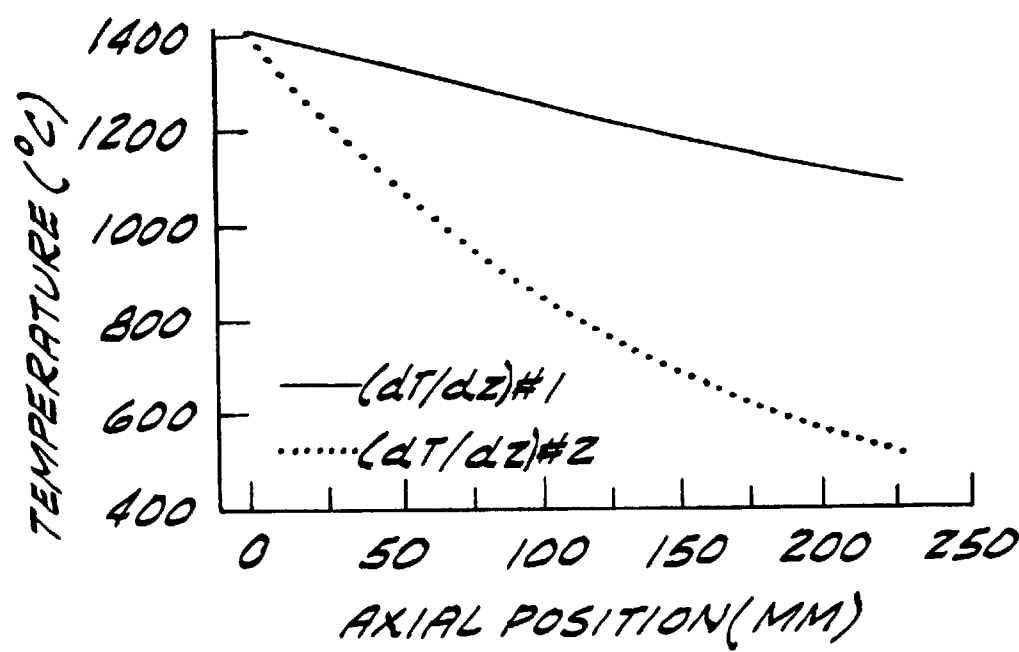
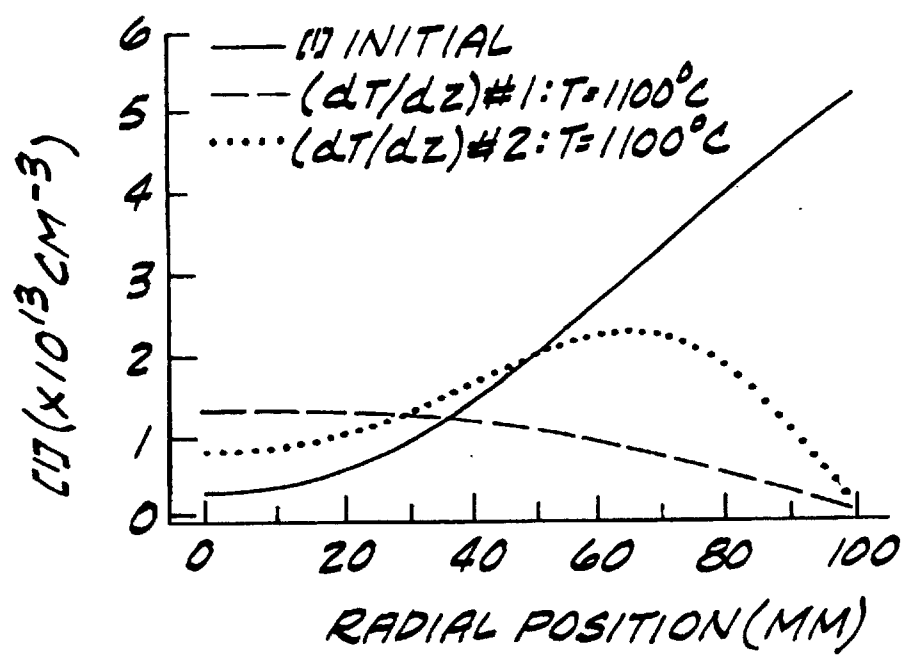


FIG. 23



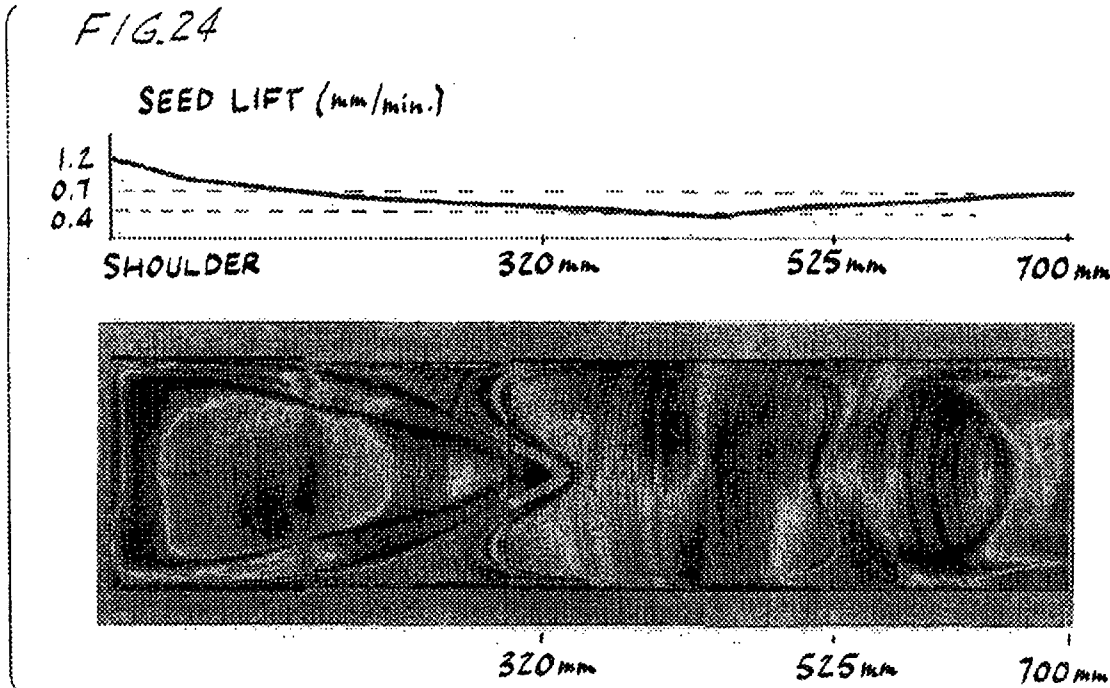


FIG. 25

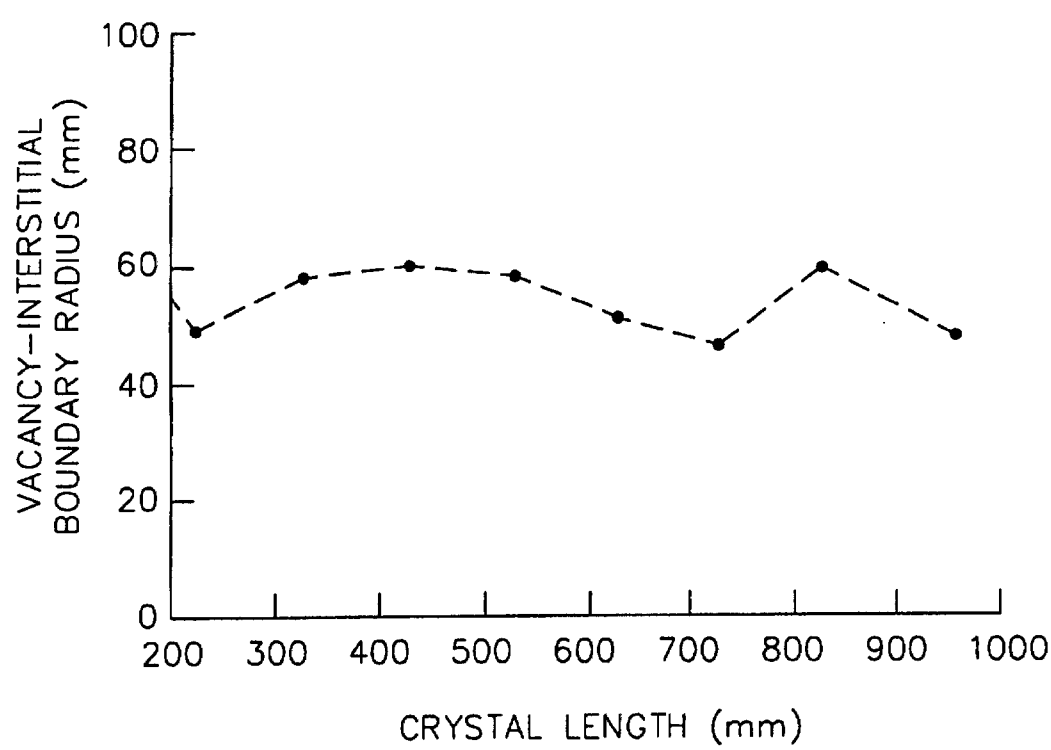


FIG. 26A

